

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**WASTEWATER TREATMENT STRIP**

(Ac.)

**CODE 635**

**DEFINITION**

A treatment component of an agricultural waste management system consisting of a strip or area of herbaceous vegetation.

**PURPOSE**

The purpose of this practice is to improve water quality by reducing loading of nutrients, organics, pathogens, and other contaminants associated with animal manure and other wastes and wastewater by treating agricultural wastewater and runoff from livestock holding areas with:

- Rapid infiltration,
- Overland flow, or
- The slow-rate process.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies:

- Where a treatment strip is a component of a planned agricultural waste management system with less than 500 animal units.
- Where a treatment strip can be constructed, operated, and maintained without polluting air or water resources.
- To the treatment of contaminated runoff from such areas as feedlots, barnyards, and other livestock holding areas.
- To the treatment of dilute wastewater such as milk house effluent and diluted silage leachate.

**CRITERIA**

**General Criteria Applicable to All Purposes**

The installation and operation of the wastewater treatment strip shall comply with all federal, state, and local laws, rules, and regulations.

Inflow to wastewater treatment strips shall be pretreated as appropriate.

Discharge to and through treatment strips shall be as sheet flow. Some means such as a ditch, curb, or gated pipe shall be provided to disperse concentrated flow and ensure sheet flow across the width (dimension perpendicular to flow length) of the treatment strip. Land grading and structural components necessary to maintain sheet flow throughout the length (dimension parallel to the flow) of the treatment strip shall be provided as necessary.

Permanent herbaceous vegetation consisting of a single species or a mixture of grasses, legumes, and/or other forbs adapted to the soil and climate shall be established in the treatment strip. Vegetation shall be able to withstand anticipated wetting and/or submerged conditions. The vegetation seeding shall be according to Conservation Practice Standard 342, Critical Area Seeding.

Clean water shall be diverted from the treatment strip to the fullest extent possible unless needed to promote vegetation growth in the treatment strip.

Treatment strips should be located outside of flood plains. However, if site restrictions require location within a flood plain, they shall be protected from inundation or damage from a 25-year flood event (or larger if required by law).

Designs shall be based on the latest edition of the Environmental Protection Agency Technology Transfer Process Design Manual for Land Treatment of Municipal Wastewater; the design procedure in Chapter 10 of NEH 651, Agricultural Waste Management Field Handbook; or other technically acceptable reference.

#### **Additional Criteria for Rapid Infiltration Treatment**

Rapid infiltration treatment refers to a specific remediation technique that utilizes the filtering capabilities of moderately and highly permeable soils. Treatment for this purpose shall consist of directing wastewater or contaminated runoff from a livestock holding area into a uniformly graded strip or area of herbaceous vegetation and allowing it to flow over and infiltrate the treatment strip. This method is not appropriate for treatment of wastewater containing high concentrations of nutrients.

Contaminated runoff shall be pretreated by solid/liquid separation utilizing a facility such as a settling basin prior to discharge of liquid to the treatment strip. The minimum storm detention time in the sediment basin shall be 15 hours.

The treatment strip shall be a uniformly graded strip or wide-bottomed trapezoidal channel with zero slope from side to side. The minimum slope shall be 0.5 percent, and the maximum slope shall be 4.0 percent. The strip shall be separated into borders with maximum widths as follows:

Slope	Border Width
0.5 - 1.0%	50 ft
1.1 - 2.0%	40 ft
2.1 - 4.0%	30 ft

The minimum ridge height of the borders shall be 0.8 foot. The maximum length of the strip shall be 1000 feet with flow redistribution devices installed every 400 feet across (perpendicular to flow) the width of the strip.

The treatment strip design shall be based on the runoff volume from the 25-year, 24-hour storm event from the livestock holding facility. It may be designed to infiltrate a portion or the entire volume of the design storm, but the minimum infiltration shall be the runoff from a 2-year, 24-

hour storm. This determination will be based on management objectives. The portion of the design volume not infiltrated shall be transferred to a storage facility unless discharge is permitted by applicable regulations. The 25-year, 24-hour storm discharge shall have a flow time greater than 1 hour, a flow depth of less than 6 inches, and velocity less than 1.5 fps.

Area requirements of the treatment strip shall be based on the capacity of the soil to infiltrate and retain runoff within the root zone and the capability of the vegetation to utilize the nutrient loading. The ability of the soil to infiltrate and retain runoff shall be based on its water holding capacity in the root zone, infiltration rate, permeability, and hydraulic conductivity. This determination shall be based on the most restrictive soil layer within the root zone regardless of its thickness. The maximum moisture storage volume shall be 50 percent of the available water capacity in the soil profile. Treatment strips shall not be installed in sandy soils where the infiltration (or intake family) equals or exceeds 1.5 inches per hour. The anticipated nutrient loading shall not exceed the agronomic nutrient requirement of the vegetation.

The infiltration strip design shall be such that the upper soil profile remains unsaturated except during storm events and returns to an unsaturated condition within 2 days following storm events. The water table shall be either naturally deep enough or artificially lowered so that the infiltrated runoff does not mingle with the native ground water. However, the water table shall not be closer than 2 feet to the root zone. Infiltration strips shall not be planned where soil features such as cracking will result in preferential flow paths that transport untreated runoff from the surface to below the root zone.

#### **Additional Criteria for Overland Flow Treatment**

Overland flow treatment refers to a specific microbial remediation technique that has minimal infiltration of wastewater. Treatment by overland flow shall consist of the application of wastewater along the upper portion of a uniformly sloped strip of herbaceous-vegetation, allowing it to flow over the vegetated surface for aerobic treatment to a collection ditch.

The design hydraulic loading rate and application rate shall be selected based on consideration of the anticipated levels of pretreatment, quality of effluent, temperature, and other climatic conditions. A maximum hydraulic loading rate of 2 inches per day and an application rate of 8 gallons per hour per foot of slope width shall be used unless higher rates can be justified by on-site studies.

The application period shall not exceed 12 hours per day, and the application frequency shall not exceed 5 days per week unless longer application periods and frequencies can be justified based on local conditions.

The nutrients anticipated to infiltrate the treatment strip shall not exceed the agronomic nutrient requirement of the vegetation.

Overland flow treatment shall be constructed on soils with low permeability. The design shall be based on the most restrictive soil layer within the root zone. The maximum allowable permeability shall be 0.2 inch per hour unless a natural or constructed barrier within the soil profile mitigates the potential of ground water contamination.

The minimum slope length for the applied wastewater shall be 100 feet.

The sloped areas to receive wastewater shall be uniformly graded to eliminate wastewater ponding and short-circuiting for the length of the flow. Slopes shall be equal to or greater than 2 percent but shall not exceed 8 percent.

Wastewater discharged from the treatment strip shall be transferred to a waste storage facility, a waste treatment lagoon, or other facility for further treatment and/or utilization unless discharge is permitted by regulations.

#### **Additional Criteria for Treating Wastewater with the Slow-Rate Process**

The slow-rate process refers to a specific remediation technique involving the application of wastewater to a vegetated surface for treatment as it flows down through the plant-soil matrix.

The design hydraulic loading shall be based on the more restrictive of 2 limiting conditions--the capacity of the soil profile to transmit water (soil permeability) or the nitrogen concentration in the

water percolating below the root zone. The percolate nitrate-nitrogen concentration leaving the root zone shall not exceed 10 mg/L. The anticipated nutrient loading shall not exceed the agronomic nutrient requirement of the vegetation.

Storage shall be provided when the amount of available wastewater exceeds the design hydraulic loading rate or for strip non-operating periods.

Wastewater shall be applied to the treatment strip utilizing a method that will result in an even application of the entire strip and a rate that does not exceed the infiltration rate of the soil.

### **CONSIDERATIONS**

- More than one overland flow treatment strip should be considered to allow for resting, harvesting vegetation, and maintenance and to minimize the potential for overloading.
- Consider pretreating overland flow influent with solid/liquid separation to reduce organic loading, odor generation, and maintenance requirements.
- Consider suspension of application to treatment strips when weather conditions are not favorable for aerobic activity or when soil temperatures are lower than 39° F. When soil temperatures are between 39° F and 50° F, reduction of application rate and increased application period (while maintaining the hydraulic loading rate constant) should also be considered.

### **PLANS AND SPECIFICATIONS**

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Plans should include information about the location, construction sequence, and vegetation establishment.

Specifications will include:

- Length, width, and slope of the treatment strips to accomplish the planned purpose (length refers to flow length down the slope of the treatment strip).

- Herbaceous species and seed selection and seeding rates to accomplish the planned purpose.
- Planting dates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival.
- Statement that only viable, certified weed-free, high quality, and regionally adapted seed will be used.
- Site preparation sufficient to establish and grow selected species.

## **OPERATION AND MAINTENANCE**

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design.

The plan shall include the following as appropriate:

- Harvesting treatment strip vegetation as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue.
- Controlling undesired weed species, especially state-listed noxious weeds.

- Inspecting and repairing treatment strips after storm events to fill in gullies, remove flow-disrupting sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow.
- Applying supplemental nutrients as needed to maintain the desired species composition and stand density of herbaceous vegetation.
- Maintaining or restoring the treatment strip as necessary by periodically grading when deposition jeopardizes its function and then reestablishing to herbaceous vegetation.
- Routinely de-thatching and/or aerating treatment strips used for treating runoff from livestock holding areas in order to promote infiltration.
- Conducting maintenance activities only when the treatment strip is dry and moisture content in the surface soil layer will not allow compaction.
- Preventing grazing in treatment strips.

Treatment strips in arid or semiarid regions that potentially could be affected by high salinity and/or sodicity (sodium content) should be monitored for excessive salt and sodium buildup. If found to be excessive, an appropriate corrective action shall be taken.